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A line tangent to an ellipse is $y - m x = \sqrt{m^2 a^2 + b^2}$. But

$$a = \frac{c(n+1)}{2}, \text{ and } b = \frac{c(n-1)}{2},$$

$$\text{hence } y - m x = \sqrt{\frac{m^2 c^2 (n+1)^2}{4} + \frac{c^2 (n-1)^2}{4}},$$

which after reduction becomes, since $n = \frac{z}{a}$,

$$4 a^2 m^2 x^2 - 8 a^2 m x y + 4 a^2 y^2 - c^2 (m^2 + 1) z^2 - 2 a c^2 (m^2 - 1) z - a^2 c^2 (m^2 + 1) = 0. \dots\dots(e)$$

This is the tangent cylinder, and its sections are hyperbolas; as for instance that by the plane $y = 0$, for which we have

$$4 a^2 m^2 x^2 - c^2 (m^2 + 1) z^2 - 2 a c^2 (m^2 - 1) z - a^2 c^2 (m^2 + 1) = 0.$$

If $m = 0$ in equation (e) it reduces to $2 a y \mp a c \pm c z = 0$,

$$\text{or } y = \mp \frac{c}{2a} z \pm \frac{c}{2},$$

two intersecting planes.

If $m = \infty$ we have similarly $2 a x \pm c z \pm a c = 0$,

$$\text{or } x = \mp \frac{c}{2a} z \pm \frac{c}{2}.$$

MOTION OF A SPHERE ON AN INCLINED PLANE.—BY WALTER SIVERLY, OIL CITY, PA.—Let m = the mass of the sphere, a its radius, k its radius of gyration, β the inclination of the plane, u the coefficient of the dynamical friction between the plane and sphere, R the reaction of the plane on the sphere, s the space passed over by the center of the sphere in the time t , ψ the angle through which it has revolved about its center, and let it be projected down the plain with the velocity v , and at the same time impressed with an angular velocity w . For its motion,

$$m \frac{d^2 s}{dt^2} = m g \sin \beta - u R, \dots\dots\dots(1)$$

$$m k^2 \frac{d^2 \psi}{dt^2} = a u R, \dots\dots\dots(2)$$

But $R = m g \cos \beta$, hence from (1) and (2)

$$\frac{d^2 s}{dt^2} = g (\sin \beta - u \cos \beta), \dots\dots\dots(3)$$

$$k^2 \frac{d^2 \psi}{dt^2} = a g u \cos \beta. \dots\dots\dots(4)$$

Integrating (3) and (4),

$$\frac{ds}{dt} = g t (\sin \beta - u \cos \beta) + v, \dots\dots\dots(5)$$

$$\frac{d\phi}{dt} = \frac{a u g t \cos \beta}{k^2} + w. \dots\dots\dots(6)$$

Integrating (5) and (6), (supposing $s = 0$ and $\phi = 0$ when $t = 0$.)

$$s = \frac{1}{2} g t^2 (\sin \beta - u \cos \beta) + v t, \dots\dots\dots(7)$$

$$\phi = \frac{a u g t^2 \cos \beta}{2 k^2} + w t. \dots\dots\dots(8)$$

If the plane be smooth $u = 0$, hence from (6)

$$\frac{d\phi}{dt} = w.$$

The angular velocity is constant, and if $w = 0$

$$\frac{d\phi}{dt} = 0,$$

and from (8) $\phi = 0$; hence a sphere placed on a smooth inclined plane will not *roll* but *slide*, and the foot note, page 35, from Peck's *Mechanics*, is not correct. See *Walton's Mechanical Problems*, prob. 7, p. 446, 3d Edition.



NOTE ON RIGHT-ANGLED TRIANGLES.—BY JOSEPH B. MOTT, NEOSHO, Mo.—In any right-angled triangle $A B C$, $A C$ being the base, $C B$ the perpendicular and $A B$ the hypotenuse, if we put $a^2 + 1 =$ the hypotenuse and $a^2 - 1 =$ the base, we shall have (Eud 47, I,) $2 a =$ the perpendicular. Hence if we maintain the above *relation* between the sides, we may assign any value whatever to a , either whole or fractional, and all the sides of the triangle will be rational.

For instance, if $a = 1$, (h , b and p representing respectively the hypotenuse, base and perpendicular) we have

$$p = 2 \times 1 = 2, b = 1^2 - 1 = 0, h = 1^2 + 1 = 2.$$

$$\text{If } a = 2, p = 2 \times 2 = 4, b = 2^2 - 1 = 3, h = 2^2 + 1 = 5.$$

$$\text{If } a = 3, p = 2 \times 3 = 6, b = 3^2 - 1 = 8, h = 3^2 + 1 = 10.$$

And if $a =$ any other value, as 4, 5, 6, 7, 8, &c., the corresponding sides are found to be 8, 5, 17; 10, 24, 26; 12, 35, 37; 14, 48, 50; 16, 63, 65, &c.

If a be assumed fractional, say $\frac{5}{4}$, $\frac{6}{5}$ and $\frac{7}{6}$ in succession, we shall have for the sides $\frac{1}{16}$ (41, 9, 43); $\frac{1}{9}$ (34, 16, 30), and $\frac{1}{4}$ (29, 21, 20).